PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Rakib et al.

Art Unit: Unknown

Examiner: Unknown

Serial No. Unknown

Docket No. TER-002.3P D6

Filed: 1/16/01

For: **APPARATUS AND METHOD FOR SCDMA DIGITAL DATA TRANSMISSION USING ORTHOGONAL CODES AND A HEAD END MODEM WITH NO TRACKING LOOPS**

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Honorable Commissioner
of Patents and Trademarks
Washington, D.C. 20231

Morgan Hill, California
January 16, 2001

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the above identified case as follows.

IN THE DRAWINGS

Enclosed are markups of Figures 53B and 53C to conform these figures to the description of the process given in Figure 60 and the specification changes described below with the changes marked in red. Also enclosed is a markup of Figure 60 with changes marked in red to eliminate duplicate reference numbers.

IN THE SPECIFICATION

At page 1, line 1, please delete the title and insert the following new title --

APPARATUS AND METHOD FOR TRELLIS ENCODING DATA FOR TRANSMISSION IN DIGITAL DATA TRANSMISSION SYSTEMS--

At page 143, line 26, after ".", insert --When the RU sends training data, it sets tap coefficients of its precode equalization filter such as filter 563 in Figure 33 to values that cause the precode equalization filter to not predistort the training data signal.--

At page 144, line 8, delete the sentence "The RU then sets these final tap weight coefficients into FFE and DFE equalizers within the precode equalizatin filter 563 in the transmitter of Figure 33, as symbolized by step 1124." and substitute, --To calculate the new coefficients for the precode equalization filter 563 in the RU transmitter of Figure 33, the old coefficients of the RU precode filter FFE and DFE equalization filter are convolved with the new coefficients FFE and DFE coefficients which the central unit modem symbol equalizer circuit converged on to derive new coefficients. These new coefficients are then set into the RU precode filter.--

At page 144, line 17, delete "tap weight coefficients of FFE and DFE" and substitute --the main tap of said FFE equalizer 921 in Figure 50 to one and sets the side tap coefficients of the FFE equalization filter 921 and the DFE equalization filter 929 in Figure 50 to zero --. At line 18, delete "equalizers 765 and 820, respectively to one".

At page 145, lines 10 through 13, delete the sentence "After convergence, the RU CPU reads the final tap weight coefficients for the FFE equalizer 765 and the DFE equalizer 820 via bus 833 and, in this alternative embodiment, sends these tap weight coefficients to the FFE/DFE circuit 764 in the RU receiver of Figure 30 via bus 822, as symbolized by step 1132." and substitute the following --After convergence, the RU CPU reads the final tap weight coefficients for the FFE equalizer 765 and the DFE equalizer 820 via bus 833 and calculates new tap weight coefficients for the FFE and DFE filters of the CE circuit 764 in the RU receiver of Figure 30 by convolving the old

CE filter tap weights with the FFE and DFE filter tap coefficients converged upon by the SE circuit during reception of multiple bursts of training data, and loads these newly calculated tap weight coefficients into the FFE and DFE filters of CE circuit 764 in the RU receiver of Figure 30 via bus 844, as symbolized by step 1132 of Figure 53C.--.

At page 169, line 17, delete "1502" and subsitute --1501--.

At page 169, line 21, delete "1504" and subsitute --1507--.

At page 169, line 29, delete "1506" and subsitute --1509--.

At page 169, line 31, delete "1508" and subsitute --1511--.

At page 170, line 2, delete "1510" and subsitute --1513--.

At page 170, line 10, delete "1512" and subsitute --1515--.

At page 170, line 5, delete "1516" and subsitute --1517--.

At page 170, line 12, delete "1514" and subsitute --1519--.

At page 170, line 14, after "." and before "Then", insert --The main tap coefficient of the SE feed forward equalization filter is then set to one and the side tap coefficients of the SE feed forward and decision feedback equalization filters are set to zero for receipt of payload data.--

At page 187, delete the entire paragraph that extends from line 24 to line 27.

IN THE CLAIMS

Please cancel claims 1-83 from the parent spec and add the below claims:

1. An remote transceiver for use in a system having a plurality of remote transceivers that transmit synchronous time division multiplexed frames of upstream data to a central transceiver on a shared medium on the same frequency, comprising:

a time division multiplexed receiver having any conventional clock and carrier recovery circuits, for recovering a master clock and master carrier

transmitted downstream and generating local clock and carrier signals that are synchronized with the recovered master clock and master carrier, and having conventional demodulator, demultiplexer and detector circuits to recover downstream payload data;

a conventional time division multiplexed transmitter coupled to receive upstream payload data and said local clock and local carrier signals and organize said payload data into timeslots and transmit said timeslots, but said transmitter having an improvement comprising any type ranging circuitry that cooperates with a central transceiver to determine a transmit frame timing delay which will cause frame synchronization to exist such that each frames transmitted by said remote transceiver arrives at said central transceiver timed so as to have its timeslot boundaries exactly lined up in time with the timeslot boundaries of frames transmitted by other remote transceivers that have already achieved frame synchronization.

2. The apparatus of claim 2 wherein said central transceiver sends downstream frames to each remote transceiver multiplexed in any way including no multiplexing and modulated in any way, and wherein said synchronous time division multiplexed transmitter generates frames of the same size as said downstream frames and said ranging circuitry is structured to establish said transmit frame timing delay such that frames transmitted by said remote unit modem have their frame boundaries aligned in time not only with the frame boundaries of other remote transceivers which have achieved frame synchronization but also correctly aligned in time with frame boundaries estabished by an upstream frame counter in said central transceiver.

3. The apparatus of claim 2 further comprising a frequency converter coupled to said remote transceiver transmitter for converting the output frequency of said transmitter to a frequency that does not interfere with downstream transmissions from said central transceiver or with any other transmissions on said shared medium.

4. The apparatus of claim 1 wherein said remote transmitter transmits upstream frames with a gap between each frame during which no upstream payload data is transmitted, and wherein said ranging circuitry comprises means for carrying out a ranging process before any upstream payload data is sent comprising an iterative trial and error adjustment of said transmit frame timing delay followed by transmission of a ranging signal with good correlation properties such that it can be found in the presence of noise and continuing this iterative process until a message is received from said central transceiver that said ranging signal has arrived in a gap, and then for transmitting identification information during an authentication interval that identifies this particular remote transceiver, and then for cooperating with said central transceiver to carry out a fine tuning process to adjust said transmit frame timing delay such that the frame and timeslot boundaries of frames and timeslots transmitted by said remote transceiver exactly line up in time at the input to said central transceiver with frames and timeslots transmitted by other remote transceivers that have achieved frame synchronization.

5. The apparatus of claim 1 wherein said remote unit transmitter transmits upstream frames with a gap between each frame during which no upstream payload data

is transmitted, and wherein said ranging circuitry comprises a computer programmed to coordinate the implementation of a trial and error ranging process prior to transmission of any upstream data, said ranging process comprised of the steps of said computer setting an initial transmit frame timing delay value and transmitting that value to said time division multiplexed transmitter and said transmitter using said value to time the transmission of a ranging signal that can be found in the presence of noise, and then said computer iteratively changing the transmit frame timing delay value and causing said transmitter to transmit another ranging signal until one or more messages are received by said receiver from said central transceiver are received that said ranging signal has been received and by how much and in what direction to adjust said transmit frame timing delay value to achieve frame synchronization, said computer then setting said transmit frame timing delay value at said value which causes frame synchronization to exist and thereafter using said value for subsequent transmission of upstream frames of payload data.

6. The apparatus of claim 1 wherein said transmitter transmits data upstream to said central transceiver in frames separated by gaps, and wherein said computer is further programmed to transmit identification information to said central transceiver during an authentication interval after said receiver first receives a message a said ranging signal has been found in a gap by said central transceiver, said identification information comprising transmission of said ranging signal in a unique sequence that identifies said remote transceiver during an authentication interval comprised of a plurality of gaps, said unique sequence comprised of transmission of ranging signals during a predetermined number of said gaps that do not have to be contiguous and silence

during the remaining gaps of said authentication interval, and further programmed to determine if after sending said identification information said receiver receives a message directed to said remote transceiver indicating said central transceiver has received said identification information and knows who sent said ranging signal, and further programmed to monitor said receiver for reception of a fine tuning message from said central transceiver indicating by how much and in which direction to adjust said transmit frame timing delay to achieve frame synchronization.

7. A synchronous multiplexed central transceiver for use in a digital data communication system comprised of said central transceiver coupled by a shared transmission medium to a plurality of remote transceivers, comprising:

a downstream transmitter means for using any multiplexing and any modulation technique to transmit data from different services downstream to said plurality of remote transceivers;

an upstream TDMA or SCDMA receiver means of any design for receiving time division multiplexed or code division multiplexed transmissions from all of said remote transceivers; and

ranging means for receiving ranging transmissions from said remote transceivers and sending messages to said remote transceivers that they can use to achieve frame synchronization such that each frame of code division multiplexed or time division multiplexed data transmitted from a remote transceiver that arrives at said receiver means arrives with its frame boundaries virtually exactly aligned in time with the frame boundaries of frames transmitted from other remote transceivers that have already achieved frame

synchronization.

8. The apparatus of claim 7 further comprising:

a master clock oscillator coupled to said transmitter means and said receiver means;

a master carrier oscillator coupled to said transmitter and and said receiver means; and

wherein said receiver means includes means for using said master clock and master carrier signals and preamble data received from each remote transceiver to receive upstream data therefrom.

9. The apparatus of claim 7 wherein said receiver means includes conventional clock and carrier recovery circuits to recover the chip clock or symbol clock and carrier signal used by each remote transceiver to transmit upstream preamble and payload data and for using said recovered clock and carrier signals to receive said upstream preamble and payload signals.

10. A process of synchronous time division or code division multiplexed upstream transmissions of digital data to a headend transceiver on the same frequency over a shared transmission medium from a plurality of distributed remote transceivers all at different distances from a headend transceiver comprising the steps:

receiving at a remote transceiver upstream digital payload data from one or more sources and organizing said data into frames of symbols to be transmitted, each frame comprised of a plurality of timeslots each containing

symbols derived from said upstream digital payload data;

iteratively transmitting a ranging signal, and determining a transmit frame timing delay value for said ranging signal that will cause said ranging signal to arrive at a reference time in a gap in upstream transmissions during which no remote transceiver is allowed to transmit anything other than ranging signals, said transmit frame timing delay value being such that if it is imposed before transmission of each frame of upstream symbols, each frame of upstream symbols transmitted from said remote transceiver will arrive at said headend transceiver with its frame boundaries and timeslot boundaries aligned virtually exactly in time with the frame and timeslot boundaries of other frames of upstream symbols transmitted by other remote transceivers which have achieved frame synchronization.

11. The process of claim 10 wherein said determining step comprises the following steps:

iteratively transmitting said ranging signal prior to transmission of any payload data;

adjusting a transmit frame timing delay value before the transmission of each ranging signal until a message is received from said central transceiver that a ranging signal has been detected in a gap that exists between each upstream frame of payload data during which gap transmission of payload data by any remote transceiver is not allowed;

when said message that a ranging signal has been found in a gap is received, transmitting identification data from said remote transceiver to

said headend transceiver that identifies said remote transceiver;

receiving a message that indicates that only one remote transceiver's ranging signal has been found in the gap and giving the identification of that remote transceiver and comparing that identification to the identification of said remote transceiver that transmitted said ranging signal;

if there is a match, using data in a message indicating by how much and in which direction to adjust the transmit frame timing delay of said remote transceiver that transmitted said ranging signal to adjust said transmit frame timing delay such that said ranging signal arrives at a reference time in each gap; and

thereafter using said transmit frame timing delay to transmit upstream frames of payload data.

12. The process of claim 10 wherein said determining step comprises the following steps:

transmitting one or more ranging signals from a remote transceiver which can be detected by said headend transceiver in the presence of noise;

in the headend transceiver, determining the identity of the remote transceiver that transmitted the ranging signal in any way;

in said headend transceiver, calculating how far off the ranging signal transmitted by a particular remote transceiver is from a reference time in a gap in upstream transmissions during which no remote transceiver may transmit anything other than ranging signals;

sending a downstream message from said headend transceiver to the remote transceiver which transmitted said ranging signal instructing it by how much to adjust its transmit frame timing delay so as to achieve frame synchronization such that frames transmitted by said remote transceiver will arrive at said headend transceiver with their frame boundaries virtually exactly aligned in time with frame boundaries of frames transmitted by other remote transceivers that have already achieved frame synchronization;

in the remote transceiver which transmitted said ranging signal, adjusting said transmit frame timing delay per the instructions from said headend transceiver, and, thereafter, using said transmit frame timing delay for subsequent upstream frame transmissions.

13. A plurality of computer data signals encoding digital upstream data from different sources, each computer data signal embodied in a carrier wave of the same frequency and transmitted from one of a plurality of physically distributed transmitters on a shared transmission medium toward a spread spectrum receiver capable of receiving all the carrier waves and recovering the digital upstream data from each source, each computer data signal organized in numbered frames where each frame is comprised of individual elements transmitted in individual timeslots, each timeslot containing spread spectrum data representing the summation of partial products resulting from the spreading of the spectrum of digital upstream data of one or more logical channels from one or more of said different soruces, each logical channel having its spectrum spread by a different spreading code, and wherein each frame having a particular number transmitted from a transmitter has its frame and timeslot

boundaries virtually exactly aligned in time with frames of like number from all other said transmitters which have achieved frame synchronization.

REMARKS

Prior Art

Some of the claims added by this preliminary amendment which do not require ranging gaps between every frame in the upstream transmissions are similar to DOCSIS 1.0 ranging which dates back to approximately 1997 or 1998. However, the ranging disclosures of the specification date back to a parent case serial number 08/519,630 filed in 8/25/95 so the DOCSIS 1.0 modems are not believed to be prior art.

In the enclosed IDS, the "Seki: A Wireless Multimedia Network on a Time Division DuplexCDMA/TDMA" published in IEICE Transactions On Communications, Vol. E78-8, No. 7 July 1995 and U.S. patent 5,327,455 were apparently the most pertinent references to the EPO examiner in the TER-002.2P parent case EPO version on a claim set directed to an RU upstream synchronous CDMA method including a ranging step to achieve frame synchronization. The claims presented herein are directed to ranging and training processes standing alone regardless of whether the upstream multiplexing is CDMA or TDMA. The Seki reference teaches that it is known to teach a bidirectional wireless digital data communication system with a plurality of distributed remote units that communicate with a central unit. The central unit is coupled to an ATM local area network and transmits high speed video signals to the remote units via a TDMA downstream. Each frame in the downstream includes an interval devoted to CDMA upstream signals. Low speed human interface signals such as keyboard input, mouse input etc. to interact with the central unit are direct sequence spread with a unique spreading code assigned to each remote unit. The central unit uses a bank of CDMA

receivers, each of which demultiplexes the CDMA signals received from one remote unit during the CDMA interval.

U.S. patent 5,327,455 teaches a transmitter for synchronous code division multiplexed satellite communications. The manner of achieving code synchronization is not taught and is said to be conventional. There is no teachings of transmitting data in frames, and no teaching of the need for or any manner of achieving frame synchronization. The patent teaches encoding an incoming bit stream to generate multiple symbols per bit and then mapping the symbols in PSK modulator to points in a constellation with, for example, a Trellis encoder, such that inphase and quadrature bit streams are generated. Each of the separate inphaseand quadrature bit streams is separately spread with a semi-orthogonal spreading code. The resulting spread spectrum data is conventionally modulated onto two quadrature carriers which are summed and transmitted.

Specification Amendments

The amendment to specification page 143, line 26 is made to make clear that which would be apparent to one skilled in the art as inherently necessary in an upstream training process where tap coefficients of a central transceiver modem are trained and later sent down to the RU transmitter to be used there to calculate new RU precoder filter tap coefficients so as to predistort the transmitted signal so that it will arrive already equalized. Since step 1126 of Figure 53B teaches setting the coefficients of the central transceiver modem symbol equalizer circuit to one after transferring the converged coefficients to the remote transceiver transmitter, one skilled in the art would understand that the central transceiver modem is not equalizing, so the remote transceiver must be doing the equalizing for its particular signal path for that is the

reason for the transfer of the converged coefficients back down to the RU. Therefore, it would be necessary during the convergence process for the RU transmitter to not predistort the equalization training data in some embodiments, and one skilled in the art would understand this. Obviously, after the transfer of the SE converged coefficients from the CU SE circuit to the RU precode filter, the RU precode filter is doing the equalization for this RU, and it is necessary to set the CU SE filter coefficients to values which render it transparent so as to not goof up the equalization being performed by the RU precode filter. Further, the software appendices of the parent case, U.S. patent application entitled "APPARATUS AND METHOD FOR SCDMA DIGITAL DATA TRANSMISSION USING ORTHOGONAL CODES AND A HEAD END MODEM WITH NO TRACKING LOOPS", serial number 08/895,612, filed 7/16/97, define a system with remote transceiver and central transceiver modems that act in this way. This amendment should not raise new matter issues, but if the Examiner disagrees, the courtesy of a telephone call to the undersigned is respectfully requested.

The same comments apply to the amendment to page 144, line 17 with the additional comment that one skilled in the art of equalization in distributed digital data transmission systems would realize that it was an error to say that all the taps of the FFE and DFE equalization filters are set to one after convergence and transfer of the converged tap coefficients to the RU since this is an obvious error. One skilled in the art would realize that only the main tap of the FFE is set to one and the side taps of the FFE and DFE are set to zero to receieve payload data.

The amendment at page 144, line 8 conforms the description of step 1124 in the upstream equalization process embodiment of Figure 53B for the CDMA specific transmitters disclosed herein to step 1514 of the process of Figure 60 which is an

equalization process which is useful in any distributed digital data system with multiple transmitters transmitting to a singe central transceiver transmitter over different paths regardless of the type of multiplexing in use. Those skilled in the equalization art would realize that the original description of step 1124 was erroneous in not mentioning convolving the old coefficients with the new coefficients. Further, the software appendices of the parent case, U.S. patent application entitled "APPARATUS AND METHOD FOR SCDMA DIGITAL DATA TRANSMISSION USING ORTHOGONAL CODES AND A HEAD END MODEM WITH NO TRACKING LOOPS", serial number 08/895,612, filed 7/16/97, define a system with remote transceiver and central transceiver modems that act in this way. This amendment should not raise new matter issues, but if the Examiner disagrees, the courtesy of a telephone call to the undersigned is respectfully requested.

The change to page 145, lines 10-13 is made to correct an error that persons skilled in the art of equalization would have readily understood was made in the description of how the new CE equalization circuit coefficients are calculated after convergence of the SE coefficients. Persons skilled in the art would appreciate that the new RU receiver SE coefficients cannot be loaded directly into the RU CE equalizer circuit but must, instead, be convolved with the old CE circuit coefficients to generate the new CE coefficients. Further, this amendment conforms the description of the process of Figure 53C to the process described in Figure 60 and the accompanying text. Further, the software appendices of the parent case, U.S. patent application entitled "APPARATUS AND METHOD FOR SCDMA DIGITAL DATA TRANSMISSION USING ORTHOGONAL CODES AND A HEAD END MODEM WITH NO TRACKING LOOPS", serial number 08/895,612, filed 7/16/97, define a system with remote transceiver and central transceiver modems that act in this way. This amendment should not raise new

matter issues, but if the Examiner disagrees, the courtesy of a telephone call to the undersigned is respectfully requested.

The same comments made regarding the change to page 143, line 26 apply to the change made to page 170, line 14 since a person skilled in the art would realize that after the CU SE filter coefficients have converged and its coefficients have been sent to the RU to generate new precode filter coefficients there by convolving with the old coefficients of the precode filter, it is necessary to set the SE coefficients in the CU receiver to values such that the CU SE does not screw up the equalization now being performed by the RU precode filter. Those skilled in this art know that those tap coefficients are one for the SE FFE main tap and zero for the SE FFE and DFE side taps. No new matter is believed to be raised by this amendment.

The changes to pages 169 and 170 simply correct duplicate reference numbers which refer to different process steps.

The change to page 170, line 14 simply corrects an error which would have been detected by persons skilled in the art of equalization. After the coefficients of the SE circuit have converged and have been convolved with the old CE coefficients to derive new CE coefficients, the SE coefficients must be set to main tap = 1 and side taps = 0 since to not do so would result in the equalization being done in the RU precode filter in the case of upstream transmissions or the RU CE circuit in the case of downstream transmissions being screwed up by the SE circuit in the RU. Persons skilled in the art appreciate that after the new precode or CE coefficients have been set, the SE coefficients need to be set to a transparent state of main tap = 1 and side taps = 0 so that the SE circuit is transparent (and can start to reconverge on subsequent iterations or periodic updates of the precode or CE coefficients).

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Respectfully submitted,

Dated: January 16, 2001

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